

I claim:

- 1       **1.** An apparatus comprising a first resonator, wherein said first resonator  
2       comprises:
  - 3       a resonating element, wherein said resonating element has a resonant  
4       frequency and nodal points;
  - 5       a first electrode, wherein said first electrode underlies said resonating element  
6       and is separated from said resonating element by a first gap;
  - 7       at least one support, wherein:
    - 8       said support has a first end and a second end;
    - 9       said first end of said support and said resonating element are joined  
10      at one of said nodal points; and
    - 11      said support has a length that is less than one-quarter wavelength  
12      of said resonant frequency.
- 1       **2.** The apparatus of claim 1 wherein said resonating element is a beam.
- 1       **3.** The apparatus of claim 1 comprising four supports, wherein each of said  
2       supports and said resonating element are joined at a respective one of said nodal  
3       points.
- 1       **4.** The apparatus of claim 1 comprising an anchor that is attached to a ground  
2       plane, wherein said second end of said support and said anchor are joined.
- 1       **5.** The apparatus of claim 1 wherein said length of said support is less than one-  
2       half of a length of said resonating element.
- 1       **6.** The apparatus of claim 1 wherein said length of said support is less than one-  
2       quarter of a length of said resonating element.
- 3       **7.** The apparatus of claim 1 wherein said length of said support is not more than  
4       5 microns.
- 1       **8.** The apparatus of claim 1 wherein said length of said support is not more than  
2       2 microns.

1       **9.** The apparatus of claim 8 wherein a width of said support is not more than 2  
2       microns and a thickness of said support is not more than 2 microns.

1       **10.** The apparatus of claim 1 wherein said length of said support is not more  
2       than 1 micron.

1       **11.** The apparatus of claim 1 wherein said length of said support is equal to a  
2       width of said support.

1       **12.** The apparatus of claim 1 wherein said first gap has a minimum size when a  
2       bias voltage is applied, and wherein said minimum size is determined by an amplitude  
3       of said bias voltage.

1       **13.** The apparatus of claim 1 wherein said resonating element comprises a  
2       material selected from the group consisting of silicon, diamond and metals.

1       **14.** The apparatus of claim 1 wherein said first electrode is electrically connected  
2       to a source of an excitation voltage and wherein said resonating element is  
3       electrically connected to a source of a bias signal.

1       **15.** The apparatus of claim 1 comprising a second resonator, wherein said second  
2       resonator has a second resonating element, and wherein said second resonating  
3       element has a second resonant frequency and is mechanically coupled to said  
4       resonating element.

1       **16.** The apparatus of claim 14 wherein said apparatus is a filter.

1       **17.** The apparatus of claim 1 wherein said apparatus is an oscillator.

1       **18.** The apparatus of claim 1 further comprising a second electrode, wherein said  
2       second electrode overlies said resonating element and is separated from said  
3       resonating element by a second gap.

1           **19.** An apparatus comprising:

2               a resonating element, wherein said resonating element has:

3                   a resonant frequency;

4                   a first end and a second end;

5                   a first nodal point proximal to said first end; and

6                   a second nodal point proximal to said second end;

7               an electrode, wherein said electrode underlies said resonating element  
8               between said first nodal point and said second nodal point, and further wherein  
9               said electrode is separated from said resonating element by a gap;

10              a first support, wherein:

11                   said first support has a first end and a second end; and

12                   said first end of said first support and said resonating element are  
13                   joined at said first nodal point;

14              a second support, wherein:

15                   said second support has a first end and a second end; and

16                   said first end of said second support and said resonating element  
17                   are joined at said second nodal point;

18               and wherein said first support and said second support each have a length  
19                   that is less than one-eighth wavelength of said resonant frequency.

1           **20.** An apparatus comprising:

2               resonating means, wherein said resonating means is characterized by a  
3               resonant frequency and flexural nodal points;

4               support means for supporting said resonating means, wherein said support  
5               means is coupled to said resonating means proximal to at least one of  
6               said flexural nodal points, wherein said support means has a length  
7               that is less than one quarter of said resonant frequency.

1           **21.** An apparatus comprising a resonator, wherein said resonator comprises:

2               a resonating element having flexural nodal points; and

3               at least two supports, wherein said two supports and said resonating element  
4               are mechanically coupled proximal to two of said flexural nodal points, and  
5               wherein said two supports each have a length that is less than one-quarter  
6               wavelength of said resonant frequency.

1           **22.** An apparatus comprising a resonator, wherein said first resonator comprises:  
2            a resonating element, wherein said resonating element is characterized by a  
3            resonant frequency, and has a first end and a second end;  
4            an electrode, wherein said electrode underlies said resonating element, wherein  
5            said electrode is separated from said resonating element by a gap;  
6            a first support, wherein:  
7                said first support has a first end and a second end; and  
8                said first end of said first support and said resonating element are joined  
9                proximal to said first end of said resonating element;  
10            a second support, wherein:  
11                said second support has a first end and a second end; and  
12                said first end of said second support and said resonating element are  
13                joined proximal to said second end of said resonating element;  
14            and wherein said first support and said second support each have a length that is less  
15            than one-eighth wavelength of said resonant frequency.